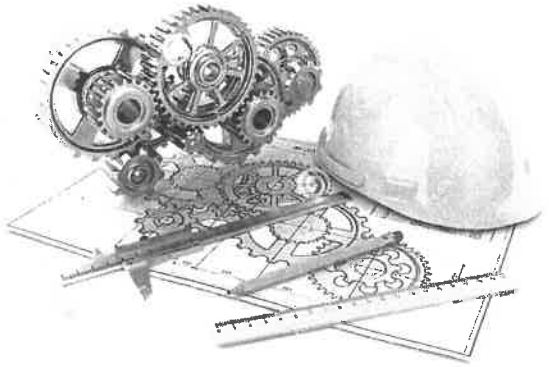
ieb assessment matters

NATIONAL SENIOR CERTIFICATE EXAMINATION

2020

ENGINEERING GRAPHICS AND DESIGN MARKING GUIDELINES

PAPER 2



MARKS:	200
TIME:	3 HOURS

FOR OFFICIAL USE ONLY					
QUESTION	SECTION	MARK	MODERATED	MAXIMUM	CODE
1	MECHANICAL ANALYTICAL			20	
2	LOCI CAM			40	
3	ISOMETRIC DRAWING			40	
4	MECHANICAL ASSEMBLY			100	
	TOTAL			200	

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of **6 pages**, including the cover page and **4 questions**.
2. **All** questions must be answered.
3. Unless specified otherwise, all questions are in **third-angle orthographic projection.**
4. Unless specified otherwise, all questions are to be completed to a **scale of 1:1**.
5. **All** answer sheets must be re-stapled in numerical order and handed in, even unanswered questions.
6. All **construction work** must be shown, even if a **stencil** was used.
7. Print your **examination number** neatly on each page.
8. Use only the **answer sheets** provided.
9. Your drawings should be **well presented** and reflect **neatness** and **accuracy**. Marks will be **deducted** for untidy and inaccurate work.
10. All dimensions or detail not given must be **assumed** in **good proportion**.
11. **Stencils** and **calculators** may be used.
12. **All** drawings must adhere to the SANS 10111-1.
13. In order to save time, **detailed assembly parts** must be **drawn to convention**.

EXAMINATION NUMBER

QUESTION 1

MECHANICAL ANALYTICAL

CAD ENGINEERING

"ENGINEERING A NEW SOUTH AFRICA"

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POLOKWANE
0699

TEL: 015 555123
CELL: 061 555123
www.cad-engin.co.za
info@cad-engin.co.za

TITLE: SPRING-LOADED RELIEF VALVE

SCALE: 1:2

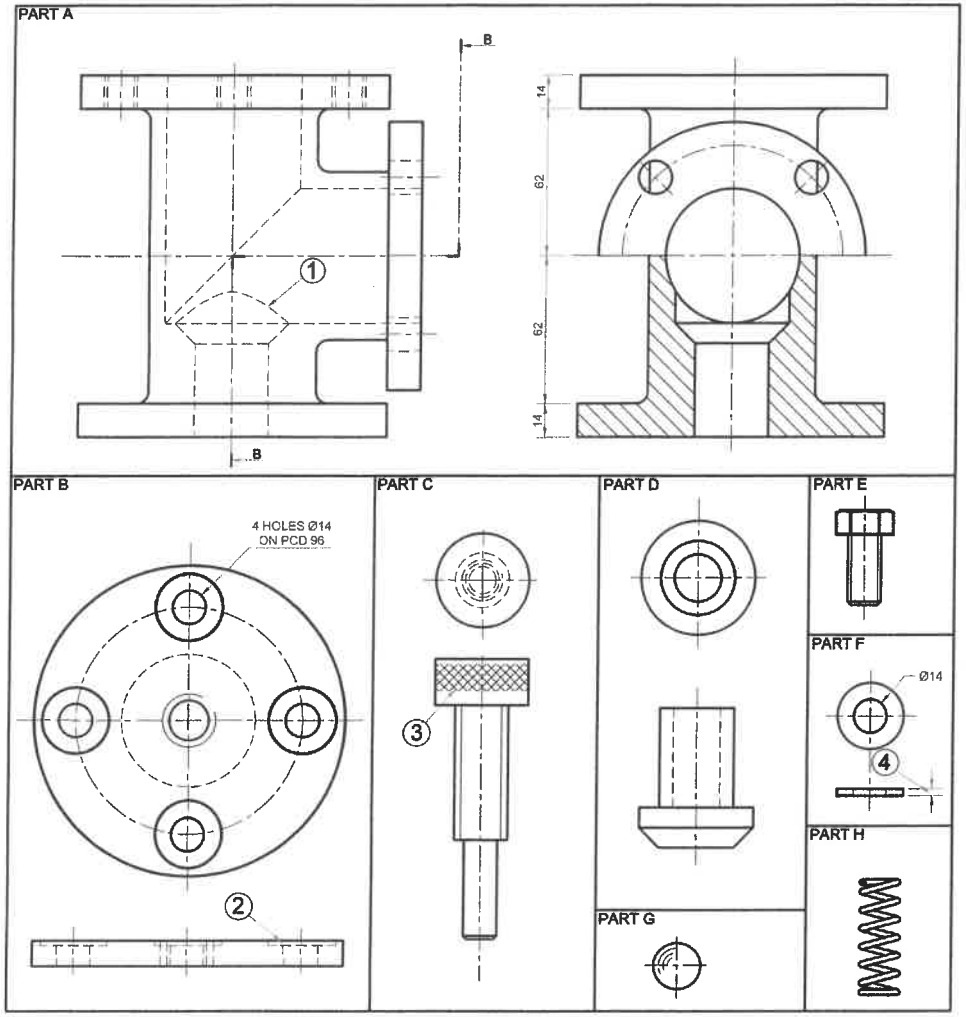
DRAWN BY: ADRIAN SMITH
CHECKED BY: JOHN ZWANE
DATE: 2 APRIL 2020
SIGNED: RJ BUNJUNG

DATE	REVISED BY	DESCRIPTION
4/4/2020	AFROX	WELDING DETAIL

ALL UNSPECIFIED RADII ARE R5.
TOLERANCES ON ALL DIMENSIONS ARE: ±0.25

PARTS LIST

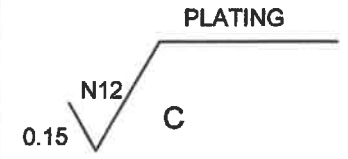
NO	PART	QUANTITY	MATERIAL
A	VALVE BODY	1	CARBON STEEL
B	VALVE COVER	1	CARBON STEEL
C	TENSION ADJUSTER	1	HIGH-TENSILE STEEL
D	VALVE	1	CARBON STEEL
E	M14 BOLT	4	HIGH-TENSILE STEEL
F	WASHER	4	MILD STEEL
G	SPHERE	1	STAINLESS STEEL
H	COMPRESSION SPRING	1	STAINLESS STEEL



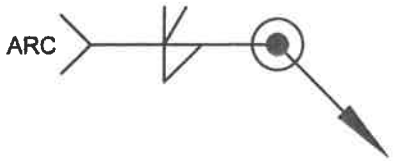
STUDY THE ADJACENT DRAWING AND ANSWER THE QUESTIONS THAT FOLLOW:

1.1 What is the tolerence on all dimensions?	(1)	±0,25
1.2 What material was used for the sphere?	(1)	STAINLESS STEEL
1.3 Name the type of sectioning in Part A?	(1)	HALF SECTION
1.4 What is the total height of Part A?	(1)	152
1.5 What is feature 1 in Part A called?	(1)	INTERPENETRATION CURVE
1.6 What is the radius of the fillets in Part A?	(1)	R5
1.7 What does the abbreviation "PCD" stand for?	(1)	PITCH CIRCLE DIAMETER
1.8 What is feature 2 in Part B called?	(1)	SPOT FACE
1.9 What is feature 3 in Part C called?	(2)	DIAMOND KNURLING
1.10 Calculate the exact dimension at 4 in Part F.	(1)	0,2 x 14 = 2.8
1.11 What is the direction of rotation for the helical spring in Part H?	(1)	CLOCKWISE / RIGHTHANDED
1.12 What direction of the lay does the machining symbol indicate?	(1)	CIRCULAR
1.13 What production method does the machining symbol indicate?	(1)	PLATING
1.14 What roughness value does the machining symbol indicate?	(1)	N12
1.15 What welding process does the welding symbol indicate?	(1)	ARC
1.16 What welding types does the welding symbol indicate?	(2)	BEVEL & FILLET

MACHINING SYMBOL

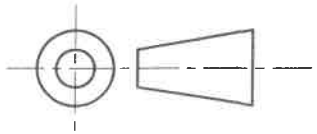


WELDING SYMBOL



1.17 In the space below, draw the symbol for Third Angle Orthographic Projection in neat freehand. (2)

PROJECTION SYMBOL



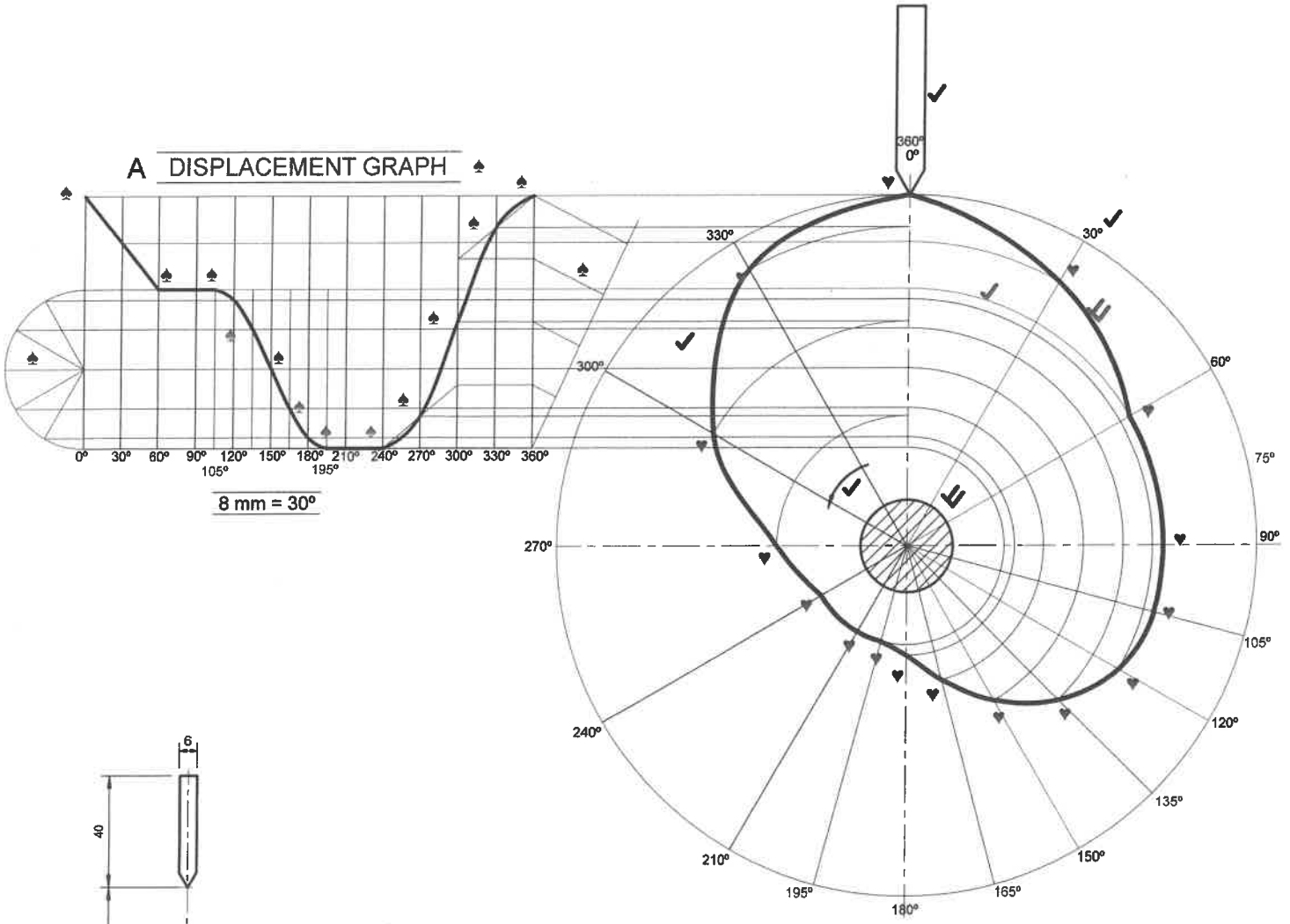
20 MARKS

ANSWER SHEET 1

EXAMINATION NUMBER

QUESTION 2

LOCI CAM



The following are given in the adjacent drawing:

- the incomplete ***graph of displacement*** in position of a ***wedge-ended*** follower.
- the vertical and horizontal centre lines of the camshaft.
- the shaft and follower detail at the starting position.

The cam imparts the following motion to the follower:

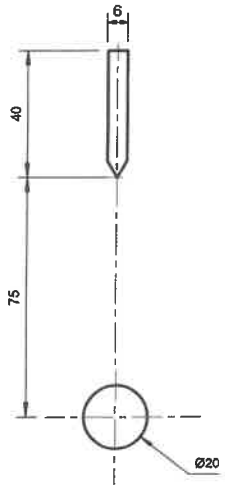
- 0° — 60° the follower ***drops*** 20 mm with ***uniform motion.***
- 60° — 105° the follower is at ***rest***.
- 105° — 195° the follower ***drops*** 34 mm with ***simple harmonic motion***.
- 195° — 240° the follower is at ***rest***.
- 240° — 360° the follower returns to its original position with ***uniform acceleration and retardation***.

The cam profile has the following specifications:

- The direction of rotation is ***anti-clockwise***.

Now do the following:

2.1 Draw the complete graph of displacement.
2.2 Draw and hatch the camshaft.
2.3 Draw the wedge-ended follower to the given measurements.
2.4 Draw the direction of rotation.
2.5 Draw and label all the divisions on the cam profile.
2.6 Draw the cam profile from the displacement graph.
2.7 Print, in capitals, the required ***label*** for the graph of displacement at **A.**
2.8 Show all constructions.



ASSESSMENT CRITERIA	
• Graph & Label	15
• Plot Points	16
• Locus & Construction	4
• Shaft and Hatching	2
• Direction & Divisions	2
• Follower	1

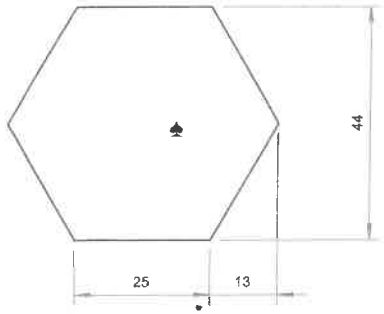
GRPH 15	♠
PTS 16	♥
LOC 4	✓
SHFT 2	✓
DIR 2	✓
FOL 1	✓

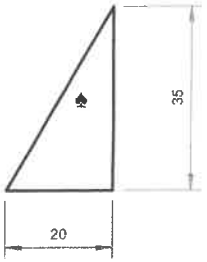
40 MARKS

EXAMINATION NUMBER

ANSWER SHEET 2

CONSTRUCTION AREA



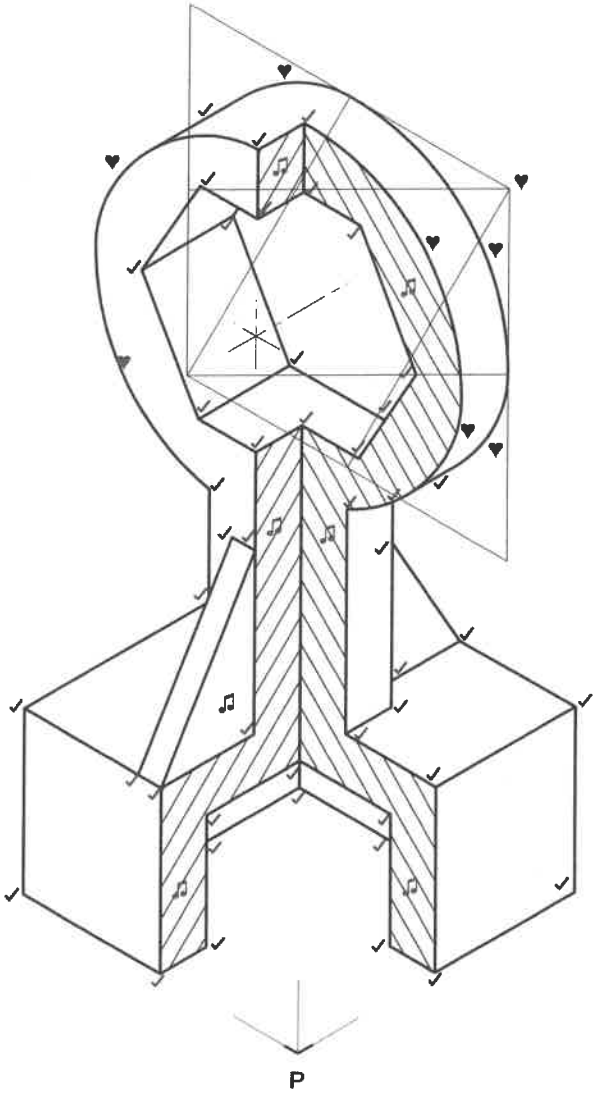


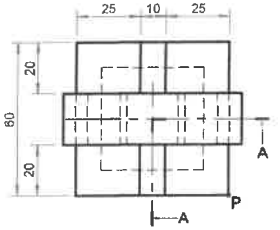
QUESTION 3

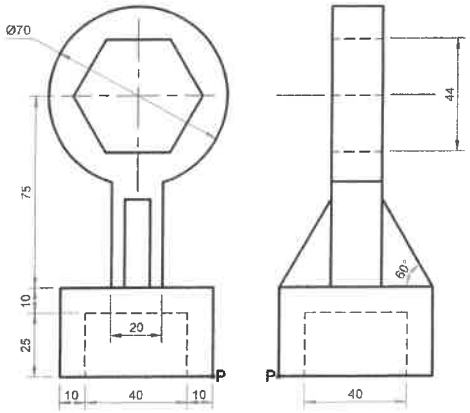
ISOMETRIC DRAWING

The figure below shows the front view, top view and right view of a heavy-duty ***CASTING***. The ***CASTING*** is cut by ***cutting-plane*** **A-A.**

3.1 Draw a neat ***half-sectioned isometric*** drawing of the ***CASTING*** on ***cutting-plane*** **A-A.**
3.2 Draw the auxilary views of the hexagon and angle in the construction area.
3.3 Do **not** draw any centre lines.
3.4 Make point P the starting point of your drawing.







Incorrect hatch angle -1
Only 1 hatch direction used -1
Incorrect position of drawing -1
Not starting at point P -1

ASSESSMENT CRITERIA

• Constructions	2
• Isometric Points 46/2	23
• Isometric Circles	8
• Hatching / Non-Hatching	7

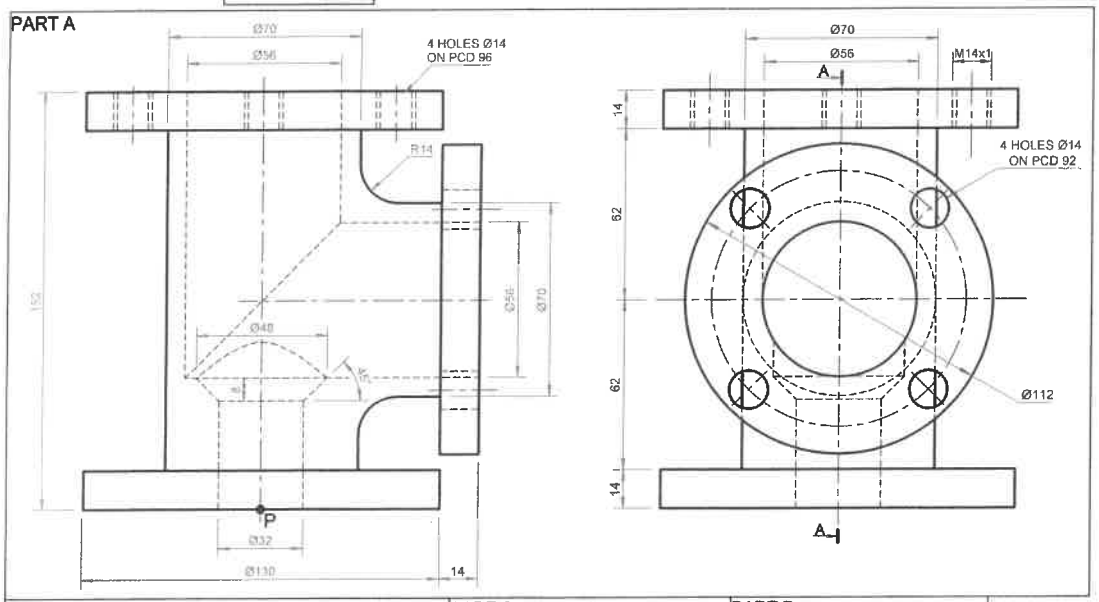
CON 2	♠
ISOM 46/2	✓
CIRC 8	♥
HAT 7	♫

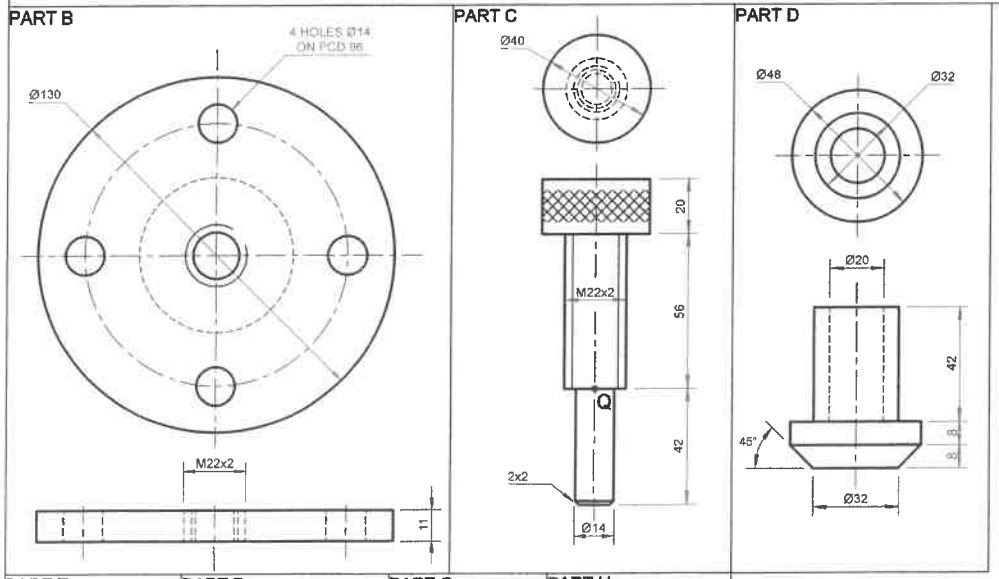
40 MARKS

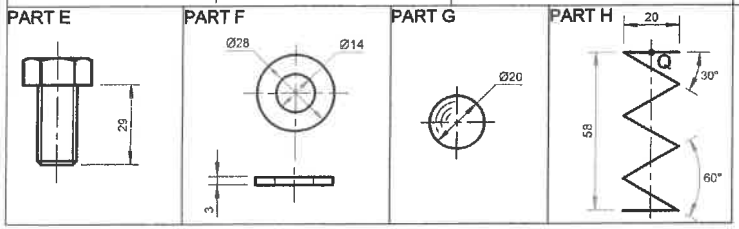
EXAMINATION NUMBER

ANSWER SHEET 3

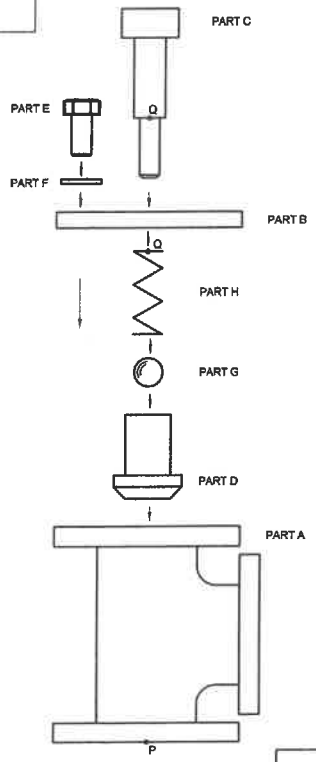
FIGURE 1







EXPLODED FRONT VIEW



100 MARKS

QUESTION 4

MECHANICAL ASSEMBLY

Figure 1 shows the different parts (not to scale) for a ***SPRING-LOADED RELIEF VALVE*** that needs to be assembled.

The ***exploded front view*** of how the parts are assembled is also shown:

Complete the following on Answer Sheet 4 to a ***scale of 1:1.***
Use the given centre lines and point **P** on the valve body (Part A) as a reference to plan the drawing layout.

4.1 Draw a ***full sectional front view*** of the assembled parts on cutting plane ***A-A.*** Draw only one bolt (Part E) and one washer (Part F) on the left-hand side of the front view.

4.2 Draw an ***outside right view*** of the assembled parts on the given centre line. Do ***not*** draw the tension adjuster (Part C), the compression spring (Part H) and the sphere (Part G) in this view.

4.3 Please note the following:

4.3.1 Show ***3 faces*** for the ***M14 hexagonal bolt-head in the front view.***

4.3.2 Show the ***hidden detail*** of only the valve (Part D) in the ***right view.***

4.3.3 Draw the centre lines on the ***front view*** only.

4.3.4 Draw the ***cutting plane*** and the ***"PCD"*** centre line in the ***right view.***

4.3.5 Insert 3 functional ***dimensions*** in the ***right view.***

4.3.6 Print the ***title*** and ***scale*** in the space provided.

4.3.7 Correctly label the completed ***front view.***

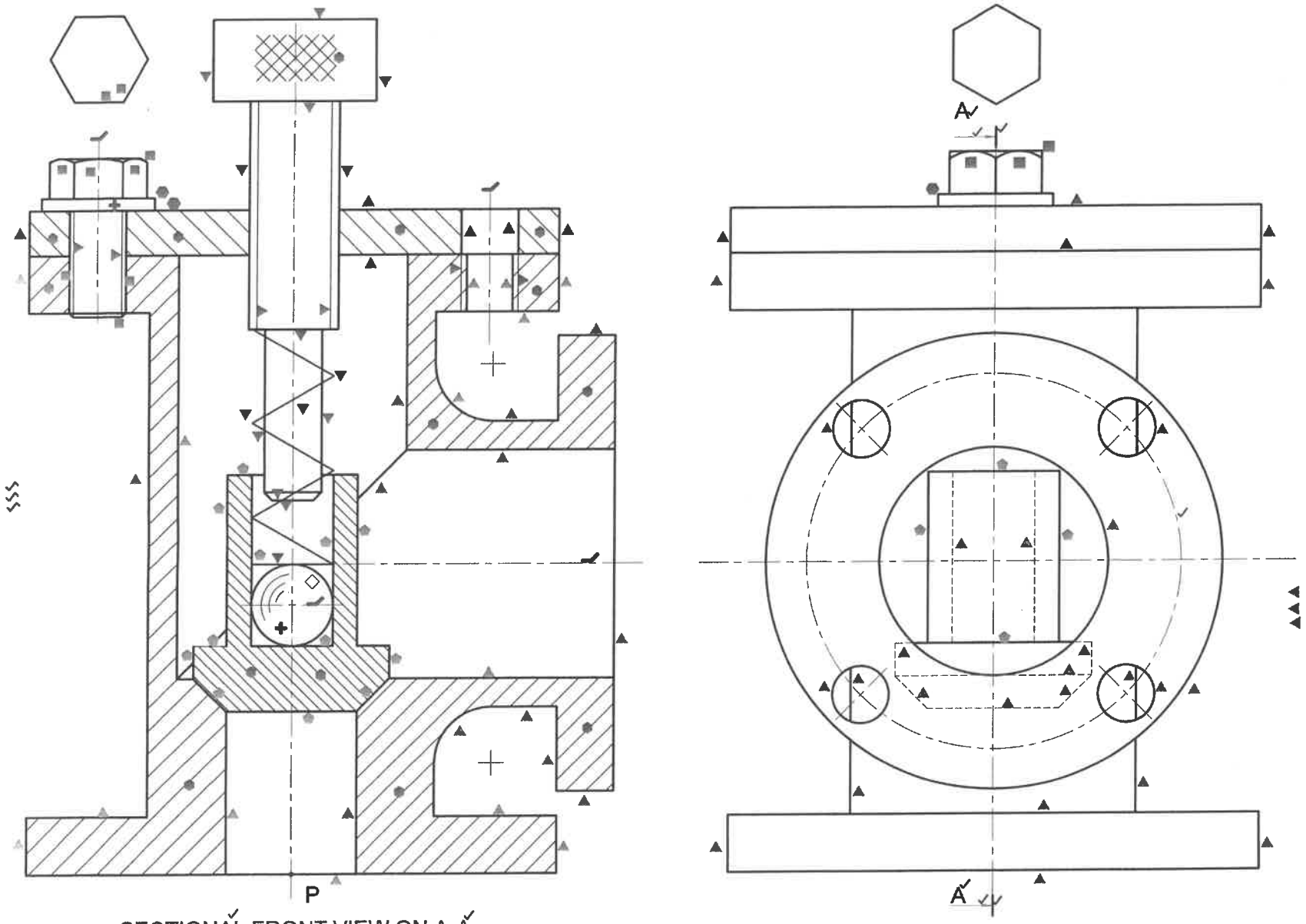
4.3.8 Match point Q on the tension adjuster (Part C) with point Q on the compression spring (Part H), when assembling the parts.

PARTS LIST			
NO	PART	QUANTITY	MATERIAL
A	VALVE BODY	1	CARBON STEEL
B	VALVE COVER	1	CARBON STEEL
C	TENSION ADJUSTER	1	HIGH-TENSILE STEEL
D	VALVE	1	CARBON STEEL
E	M14 BOLT	4	HIGH-TENSILE STEEL
F	WASHER	4	MILD STEEL
G	SPHERE	1	STAINLESS STEEL
H	COMPRESSION SPRING	1	STAINLESS STEEL

EXAMINATION NUMBER

QUESTION 4

MECHANICAL ASSEMBLY



SECTIONAL FRONT VIEW ON A-A

TITLE:	SPRING-LOADED RELIEF VALVE
SCALE:	SCALE 1:1

ASSESSMENT CRITERIA		
FRONT VIEW		
A BODY 26/2	13	▲
B COVER 6/2	3	▲
C ADJUSTER 10/2	5	▼
D VALVE 12/2	6	⬟
E M14 BOLT	9	■
F WASHER	2	⬢
G SPHERE	1	◇
H SPRING	5	▼
THREAD 6/2	3	▶
TOTAL	47	
RIGHT VIEW		
A BODY 16/2	8	▲
B COVER 4/2	2	▲
D VALVE	4	⬟
E M14 BOLT	3	■
F WASHER	1	⬢
HIDDEN DETAIL	8	▲
PCD CENTRE LINE	1	✓
TOTAL	27	
ADDITIONAL		
CORRECT ASS.	3	✓
HATCHING 14/2	7	⬟
NON-HATCHING	2	✚
CENTRE LINES	4	✓
DIMENSIONS	3	◀
CUTTING PLANE 6/2	3	✓
TITLE/SCALE/LABEL	4	✓
TOTAL	26	
TOTAL	**100**	

ANSWER SHEET 4

EXAMINATION NUMBER